J. Biol. Control, 15 (1): 43- 48, 2001

Safety of some insecticides to brown mirid bug, *Tytthus parviceps* (Reut.) (Hemiptera: Miridae), a predator of brown planthopper, *Nilaparvata lugens* (Stål) (Homoptera: Delphacidae) in Rice

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ABSTRACT: **In the greenhouse, the relative safety of thiamethoxam at 50, 25 and 12 ppm, imidacloprid at 50 ppm, fipronil at 100 ppm and check insecticide acephate at 1200 ppm along with untreated control to the brown mirid bug, *Tytthus parviceps* (Reuter) was assessed. The results revealed that thiamethoxam at 50 ppm and 25 ppm was as safe as imidacloprid 50 ppm, less safe than acephate 1200 ppm but more safe than fipronil 100 ppm.**

KEY WORDS: Insecticides, *Nephotettix virescens*, *Nilaparvata lugens*, persistent toxicity, relative safety, rice, *Sogatella furcifera*, *Tytthus parviceps*

The brown mirid bug, *Tytthus parviceps* (Reut.) is an important predator which feeds on the eggs and nymphs of rice brown planthopper, *Nilaparvata lugens* (Stål), whitebacked planthopper, *Sogatella furcifera* (Horvath), and green leafhopper, *Nephotettix virescens* (Distant) (Pathak and Saha, 1976; Alam, 1984; Manjunath *et al.*, 1978; Basilio and Heong, 1990).

Although cultural practices and varietal resistance are employed to check the damage by these pests, use of insecticides continues to be one of the major tactics employed by farmers to minimize the yield losses in rice. Thiamethoxam, imidacloprid and fipronil were recently found to be effective insecticides in the rice ecosystem for the control of hopper pests (DRR, 1996, 1998, 2000). Conservation of natural enemies is an important component of modern integrated pest management. Pesticides that are not harmful to natural enemies can be effective component of integrated pest management. The information available in literature on the safety of thiamethoxam, imidacloprid and fipronil to the natural enemies particularly to *T. parviceps* is scarce. Hence, the present studies were conducted to assess the initial and residual toxicity of these insecticides to the nymphs and adults of *T. parviceps*.

MATERIALS AND METHODS

Rice plants of variety TN1 were grown in the greenhouse at 30 $\pm$ 5^{0}C and 60 $\pm$ 10 per cent relative humidity. Brown planthopper was reared on 40-day-old rice plants in wooden cages in greenhouse. Mirid bugs were reared on rice plants preoviposited by BPH. The adult mirid bugs were confined to these plants for 2-3 days for oviposition and allowed for required period in separate cages to obtain nymphs or adults of specified age. The studies were conducted in glasshouse of Directorate of Rice Research, Hyderabad, during 1999.

Five insecticidal treatments, namely, thiamethoxam (Actara 25 WG) at 50, 25, 12 ppm; imidacloprid (Confidor 200 SL) at 50 ppm, and fipronil (Regent 5 SC) at 100 ppm were evaluated and compared with acephate (Starthene 75 WP) at 1200 ppm as standard check and an untreated control. All the treatments were replicated four times in Randomized Complete Block Design (RCBD).

The insecticides at specified concentrations were sprayed up to run-off stage on 40-day-old potted rice plants. The insects were planned for confinement on plants at 1,7,14,21 and 28 days after spraying and separate sets were maintained for each day of confinement. Rice plants were preoviposited by brown planthopper before spraying in the case of releases 1 and 7 days after spraying, whereas they were oviposited by brown planthopper after spraying in the case of releases 14, 21 and 28 days after spraying. Ten mirid bug nymphs and adults were separately confined each time with the help of suitable mylar cages and observations on mortality were recorded after 24, 48 and 72 hours of exposure.

Persistent toxicity (PT) values were calculated for each exposure period *viz.*, 24, 48 and 72 hours separately according to Pradhan (1967). PT value is the product of average per cent mortality and the period in days up to which the insecticide persisted.

The per cent mortality was transformed into angular values for analysis. PT values were subjected to square root transformation. All the data were analyzed in RCBD and the means were separated by least significant difference (l.s.d.) method (Cochran and Cox, 1957).

RESULTS AND DISCUSSION

Safety of insecticides to adults of *T. parviceps*

All the treatments up to 7 days recorded almost 100 per cent mortality of *T. parviceps* adults within 24 hours of exposure (Table 1). However, 21 days after spraying, thiamethoxam at 50 and 25 ppm registered 27.5 and 20 per cent mortality, respectively, within 24 hours of exposure and was on par with imidacloprid 50 ppm (20 % mortality) and safer than fipronil 100 ppm (100% mortality) but less safe than acephate 1200 ppm (5% mortality). After 28 days of spraying, the plants with different treatments exhibited similar results with thiamethoxam at 50 ppm (62.5% mortality within 48 hours of exposure) to be on par with imidacloprid 50 ppm (75% mortality), better than fipronil 100 ppm (100% mortality), but inferior to acephate 1200 ppm (5% mortality). Thiamethoxam at 25 and 12 ppm was comparatively safer to adults recording 45 and 15 per cent mortality, respectively than thiamethoxam 50 ppm. When persistent toxicity values at 24 hours exposure were taken into consideration, thiamethoxam at 50, 25 and 12 ppm registering PT values of 1817, 1722 and 1478, respectively was on par with imidacloprid 50 ppm (PT value of 1624), less safe than acephate 1200 ppm (PT value of 840), but more safe than fipronil 100 ppm (PT value of 2478).

Safety of insecticides to nymphs of *T. parviceps*

When mortality data of nymphs up to 7 days after spraying were considered, almost all the treatments recorded 100 per cent mortality within 48 hours of exposure (Table 2). However, 14 days after spraying, thiamethoxam at 25 and 12 ppm exerted 57.5 and 47.5 per cent mortality within 24 hours of exposure and were on par with imidacloprid 50 ppm (45% mortality), inferior to acephate 1200 ppm (7.5% mortality) but safer than fipronil 100 ppm (100% mortality). At 21 days after spraying, thiamethoxam at 50 and 25 ppm recorded 77.5 and 50 per cent mortality within 48

Table 1. Per cent mortality and persistent toxicity of insecticides to adults of *T. parviceps*

Treatment	Per cent mortality															Persistent toxicity		
	1day			7 days			14 days			21 days			28 days					
	24th	48h	72h	24th	48h	72h	24th	48h	72h	24th	48h	72h	24th	48h	72h	24th	48h	72h
Thiamethoxam 50ppm	100a	100a	100a	100a	100a	100a	100a	100a	100a	27.5b	95ab	100a	7.5cd	62.5bc	95a	1817b	2562b	2772a
Thiamethoxam 50 ppm	100a	100a	100a	100a	95a	100a	85b	95a	97.5a	20bc	85bc	100a	12.5bc	45c	57.5b	1722bc	2380c	2618b
Thiamethoxam 12ppm	100a	100a	100a	100a	100a	100a	77.5b	97.5a	100a	12.5cd	82.5b	90b	0e	15d	32.5c	1479c	2198d	2366c
Imidacloprid 50ppm	100a	100a	100a	100a	100a	100a	50c	100a	100a	20bc	65c	100a	20b	75b	97.5a	1624bc	2464bc	2786a
Fipronil 100 ppm	100a	100a	100a	100a	100a	100a	100a	100a	100a	100a	100a	100a	42.5a	100a	100a	2478a	2800a	2800a
Acephate 1200 ppm	100a	100a	100a	100a	100a	100a	15d	42.5b	100a	5de	22.5d	42.5c	2.5de	5e	12.5cd	840d	1512e	1988d
Control (untreated)	0b	0b	2.5b	0b	0b	5b	2.5e	2.5c	5b	0e	0e	2.5d	0e	0e	2.5d	14e	28f	98e

The values in each column followed by the same letter are not significantly different (p=0.05).

Table 2. Per cent mortality and persistent toxicity of insecticides to nymphs of *T. parviceps*

Treatment	Per cent mortality															Persistent toxicity		
	1day			7 days			14 days			21 days			28 days					
	24th	48h	72h	24th	48h	72h	24th	48h	72h	24th	48h	72h	24th	48h	72h	24th	48h	72h
Thiamethoxam 50ppm	100a	100a	100a	100a	100a	100a	67.5b	100a	100a	22.5a	77.5b	92.5ab	7.5b	10cd	90b	1573b	2170b	2702b
Thiamethoxam 50ppm	100a	100a	100a	100a	95a	100a	57.5bc	92.5a	100a	2.5b	50	85bc	50cd	10cd	60c	1253c	1870b	2492c
Thiamethoxam 12ppm	100a	100a	100a	72.5b	100a	100a	47.5c	87.5a	100a	2.5b	32.5de	57.5c	2.5bc	12.5c	35d	1072c	1862b	2170d
Imidacloprid 50ppm	100a	100a	100a	100a	100a	100a	45c	100a	100ac	30a	62.5bc	100a	2.5bc	35b	67.5c	1458b	2226ab	2618b
Fipronil 100 ppm	100a	100a	100a	100a	100a	100a	100a	100a	100a	32.5a	100a	100a	35a	60a	100a	2058a	2576a	2800a
Acephate 1200 ppm	100a	100a	100a	52.5c	100a	100a	7.5d	10b	28a	2.5de	25e	25d	2.5bc	5de	20d	727d	1177c	1526e
Control (untreated)	2.5b	2.5b	2.5b	0d	0b	2.5b	0d	0c	0c	0b	2.5f	5e	0c	2.5e	2.5e	14e	42d	70f98e

The values in each column followed by the same letter are not significantly different (p=0.05).

hours of exposure and was on par with imidacloprid 50 ppm (62.5% mortality) but safer than fipronil 100 ppm (100 % mortality). At the same time, thiamethoxam at 12 ppm (32.5% mortality) was as safe as check insecticide acephate at 1200 ppm (25% mortality). Based on the mortality data of *T. parviceps* nymphs, 28 days after spraying, more or less similar results were evident with regard to the safety of thiamethoxam *vis-a-vis* other insecticides. When the data on persistent toxicity values at 24 hours exposure period were considered, thiamethoxam at 50 ppm (PT value of 1572) was on par with imidacloprid 50 ppm (PT value of 1458), safer than fipronil 100 ppm (PT value of 2058) but inferior to check insecticide acephate (PT value of 726). Thiamethoxam at 25 and 12 ppm (PT values of 1253 and 1072, respectively) was safer than thiamethoxam at 50 ppm. All the insecticidal treatments at different intervals and exposure periods exhibited significantly higher mortality of nymphs and adults than untreated control.

Based on the overall results on the safety of thiamethoxam to adults and nymphs of *T. parviceps*, it can be concluded that thiamethoxam at 50 and 25 ppm was as safe as imidacloprid 50 ppm, less safe than acephate 1200 ppm (check insecticide), but safer than fipronil 100 ppm.

ACKNOWLEDGEMENTS

The financial assistance received from M/s Novartis India Limited for conducting this study is gratefully acknowledged. The authors are thankful to the Project Director for providing the facilities for conducting this work.

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